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REPORT
OF THE
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REPORT
OF THE
STATE FORESTER

FOR THE PERIOD

JULY 12, 1905, TO NOVEMBER 30, 1906

Being the First Public Report of the Office, Established by the
Act of March 18, 1905 (Chapter 264, Statutes 1905),
for the Preservation of California Forests.



SACRAMENTO:

W. W. SHANNON, : : : : SUPERINTENDENT STATE PRINTING.

1906.

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C. F. CURRY.....SECRETARY OF STATE.

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G. B. LULL.....STATE FORESTER.

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SACRAMENTO, CAL., November 27, 1906.

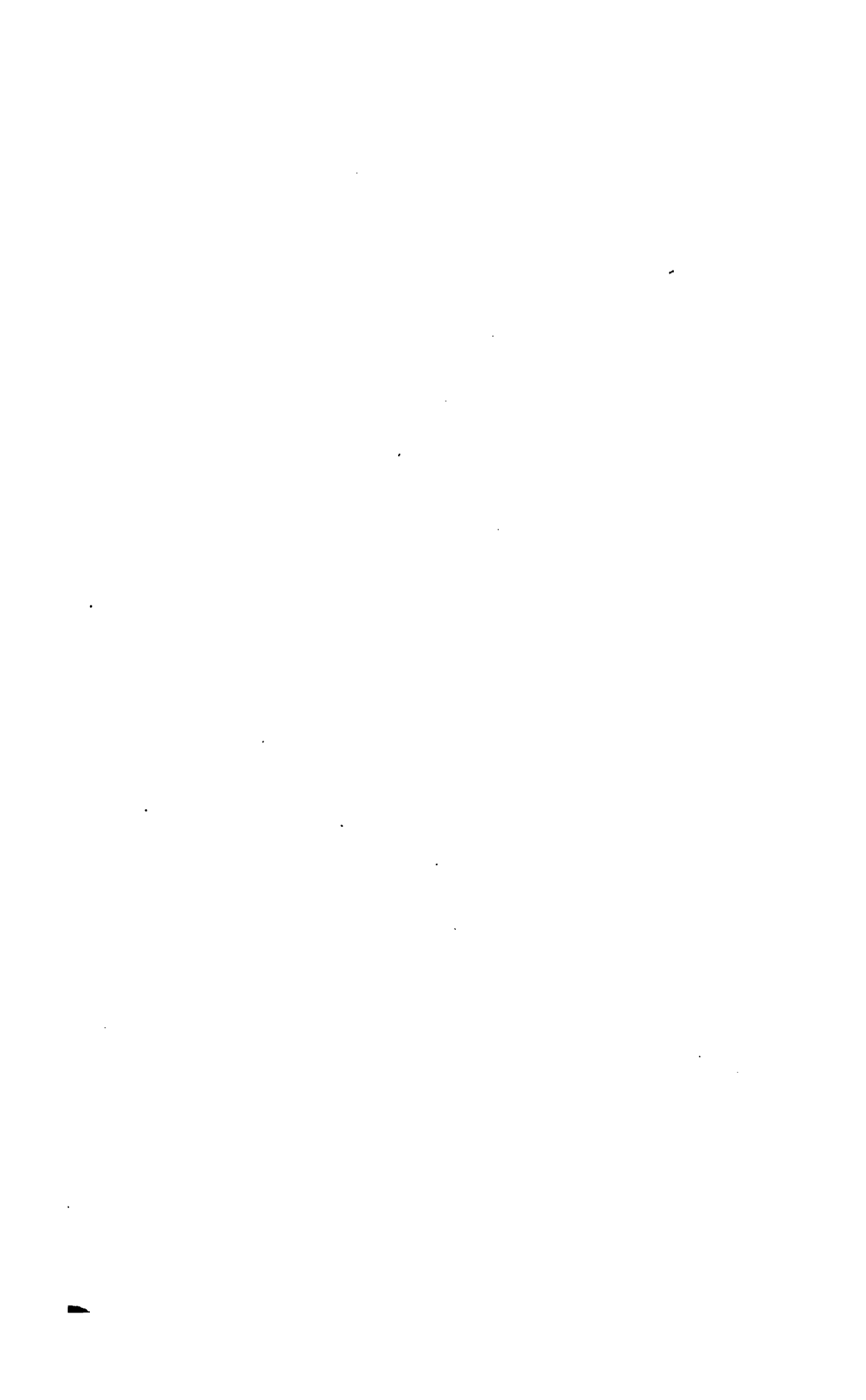
To His Excellency, GEORGE C. PARDEE, Governor of California.

SIR: I have the honor to transmit to you this first public report, reviewing the work of this office under the Act of March 18, 1905, and recommending legislative action along specified lines to broaden the scope and increase the efficiency of the forest laws. These recommendations are embodied in an amended forest bill which accompanies this report.

A detailed report of particular value for office use was submitted to you by Mr. E. T. Allen on his resignation, as State Forester, on July 1, 1906. For obvious reasons much of the information and many recommendations which appear here were taken from this earlier report.

Very respectfully,

G. B. LULL,
State Forester.



REPORT OF THE STATE FORESTER.

In this report it is proposed to treat in a practical way of the decline of the forests of California and their increasing importance to the industrial life of the State. The attitude of the State toward them will be defined and the experiences gained under the laws enacted to preserve them will be recorded. Particular emphasis will be placed on the limitations and defects of the laws, in the hope that those interested in the permanent welfare of the industries dependent on forest preservation will unite to secure more effective forestry legislation.

THE DECLINE OF THE FOREST.

To gain a clear idea of the change in the condition of the forest that has occurred in the course of settlement it will be helpful to compare its present state with the virgin forest. Picture a forest of unbroken continuity cloaking from summit to plain the mountains on both sides of the great interior valleys from the Oregon border southward to the Tehachapis where the two branches united to extend a long, hook-shaped arm over the uplifted areas surrounding San Bernardino Valley and the adjacent plain! The quality of the forest varied greatly in different localities, because numerous species were confined to certain regions by the natural factors, soil, climate, and elevation. The red-wood forest occupied an area along the northwest coast over which ocean fogs drifted in summer; spruce and fir grew in the higher elevations; next below came the cedar with sugar and yellow pine, while nearer the valley, as a fringe to the heavy forest, was a belt of shrubs, or chaparral, intermixed with oak and drought-resisting pines. This magnificent resource, covering approximately 34,000,000 acres, or one third of the State, was unequaled by that of any other State in either the size and perfection of individual trees or its location on lands unfit for other uses.

The area of forest land in the State to-day is practically identical with the original area, very little having been turned to other uses. The changes, therefore, have resulted solely in a reduction of the area of merchantable timber. Two causes have operated to effect this change, lumbering and fire.

Lumbering.

The vast amount of material taken from the forest to supply the demands of settlement and development has been duplicated or exceeded by useful timber of lesser value, which has been sacrificed and rejected. The woods are full of moss-covered trunks from which only the butt log has been taken. When only the best material would bear the cost of milling and marketing the inferior had to be left, even if there had been a thought of taking it, which is improbable, for the supply seemed inexhaustible. As a result, lumbering has left the forest in an unsightly and deplorable condition. Lumbermen have been called "vandals" because of it, yet they have simply catered to the wants of a fastidious public. Their actions have been determined by economic conditions.

It is estimated that twenty per cent of the redwood area has been cut over. Fire has been used there as a necessary step in the operation, but as a coppice growth follows in spite of it, it is doubtful if the merchantable area of redwood timber would have been permanently reduced had succeeding fires been prevented. A relatively small portion of this area, when cleared, has been turned to other uses.

In the yellow and sugar pine belt two methods of cutting have been followed: a tulling method, whereby only the larger trees are removed, and clean cutting, which results in complete removal. Practically all of the accessible portions of the Sierra forest have been worked over according to one or the other of these methods.

Fire.

The condition of the forest after lumbering is ripe for fire, the danger from which is multiplied by the protracted drought of California summers. Engines, campers, prospectors, lumbermen and, in fact, every possible source of fire, combine with these conditions to cause conflagrations. Following fire, chaparral species invade the burned area, and the composition of the forest changes from merchantable timber to brush. Thus the fringe of chaparral, which formerly bordered the forest, has invaded it to the permanent exclusion of other species, unless artificial replacement is resorted to. Chaparral now holds the land on whole townships which formerly produced merchantable timber, and the cause of its extension remains unchecked.

It must not be inferred that land encroached upon by chaparral is worthless and unworthy of care. In general, it is true that such areas will never bear merchantable timber again unless planting is resorted to, but as a protective cover to watersheds heavy chaparral is almost as good as a stand of forest species. Hence, for this reason alone the areas now occupied by chaparral should receive full protection, while

unusual care should attend lumbering to prevent fires from causing the brush to enroach still further on areas producing merchantable timber.

THE DIRECT VALUE OF THE FOREST.

The value of the forest as a source of useful material is so evident that it will be sufficient to dwell briefly on this important province. It is impossible to imagine a civilization without wood. Even the commonest articles used habitually require wood for their manufacture, although usually only the channels of greatest consumption, such as railroads, buildings, mines, etc., are considered. Moreover, the uses of wood, multifarious now, are steadily increasing.

Some conception of the direct financial significance of the forest may be gained from the following incomplete figures collected by the Forest Service:

The total cut of lumber in California during 1905 approximated 1,219,000,000 board feet, or 4.4 per cent of the total cut in the United States.

In the production of shingles California stood second, being credited with 562 million.

Virginia was the only State to exceed the 48,144 cords of tanbark supplied by California.

California's standing timber to-day probably represents an intrinsic value of much more than \$200,000,000. When manufactured it will be worth fifteen times as much, and this immense wealth will be distributed into the pockets of every citizen, because it will be created by labor and the wages will be paid into circulation. It is roughly estimated that even now the forest products of the State bring an annual revenue of \$20,000,000. Considered thus alone, as a financial resource, the value of the forest to the State assumes tremendous importance.

THE INDIRECT VALUE OF THE FOREST.

It might be possible, although perhaps prohibitively expensive, to import forest products from other states; but water must be had at home, and it is unnecessary here to dwell upon either its paramount part in the life of California or its dependence on forest-covered sources.

Although there is great divergence of opinion among laymen regarding the importance of forests in regulating run-off, general opinion is unanimous in conceding that the removal of forests is followed by the disturbance of water levels. Whenever the demand for water makes this question acute, a lucid explanation showing the almost irrevocable damage done by denuding the watersheds is commonly followed by nervous haste to repair it. This, however, requires a long period of time and often vast expenditures.

Where other industries monopolize the attention of the greater part of a community, even temporarily, so that need for water for irrigation is not pressing, forest destruction is allowed to proceed, unmindful of the future, although present populations must concede that the ultimate employment of all tillable lands will be for agriculture, and that this will be impossible without water. The two conditions can be forcibly illustrated by comparing the sentiment for forest protection and forest planting in the intensively cultivated San Bernardino Valley with the apathy existing in certain undeveloped sections of Northern California.

The awakening in the south came when Mr. W. C. Mendenhall* of the Hydrographic Survey showed conclusively that the water level of San Bernardino artesian basin is being lowered rapidly as the result of over-use, explaining further that the denudation of the tributary watersheds caused the water to pass over the valley in floods without giving it time to filter through the porous soil into the underground reservoir. Concerted action for forest replacement has characterized the south ever since.

In forested areas the mechanical force of falling rain is dissipated when it strikes the foliage, consequently the soil is not compacted. The water then drips on to the litter-covered soil or runs down the trunks to the ground, where it is prevented from following the slope to the valley by obstructing vegetation. The absorbing humus underneath the trees keeps the upper layers of soil loose and friable, while the retreating roots afford channels along which the water seeks lower levels, percolating through the soil slowly, instead of passing over it rapidly, to points below, where it is forced to the surface by an impervious stratum and released. Thus streams from forested watersheds receive their supplies slowly and regularly, which accounts for their uniformity throughout the year.

On non-forested watersheds the mechanical force of the drops compacts the upper layers of soil, which are usually hardened at the outset by exposure to sun and wind. No obstructing vegetation prevents the rapid escape of the water to the stream below along small depressions, from which, owing to its velocity, it is enabled to carry heavy loads of material. Thus streams from denuded watersheds are subject to floods immediately following every rain, which during their short duration incumber the valley below with all manner of *débris*, succeeded by lapses into drought conditions until the next rains. The City of Hollywood expends several thousand dollars every year to clear away *débris* deposited from this cause. Facts bearing on the part played by forests in regulating stream flow were brought out by some measurements made for the Forest Service in the San Bernardino Mountains in 1899 and

*The Hydrology of San Bernardino Valley. Water-Supply and Irrigation Paper No. 142.

published in a paper by Prof. J. W. Toumey, Yale Forest School, entitled "The Relation of Forests to Stream Flow." The essence of the paper is contained in the following extract:

In a careful study of the behavior of the stream flow on several small catchment areas in the San Bernardino Mountains it has been found that the effect of the forest in decreasing surface flow on small catchment basins is enormous, as shown in the following tables, where three well-timbered areas are compared with a non-timbered one:

Precipitation and Run-off during December, 1899.

Condition as to Cover.	Area of Catchment Basin.	Precipitation.	Run-off per Square Mile.	Run-off in Percentage of Precipitation.
	<i>Sq. Miles.</i>	<i>Inches.</i>	<i>Acre-feet.</i>	<i>Per Cent.</i>
Forested	0.70	19+	36—	3
Forested	1.05	19+	73+	6
Forested	1.47	19+	70—	6
Non-forested .....	.53	13—	312+	40

At the beginning of this rainy season, in early December, the soil on all four of these basins was very dry as a result of the long dry season. The accumulation of litter, duff, humus, and soil on the forest-covered catchment areas absorbed 95 per cent of the unusually large precipitation. On the non-forested area only 60 per cent of the precipitation was absorbed, although the rainfall was much less.

Rainfall and Run-off during January, February, and March, 1900.

Condition as to Cover.	Area of Catchment Basin.	Precipitation.	Run-off per Square Mile.	Run-off in Percentage of Precipitation.
	<i>Sq. Miles.</i>	<i>Inches.</i>	<i>Acre-feet.</i>	<i>Per Cent.</i>
Forested	0.70	24	452+	35
Forested	1.05	24	428+	33
Forested	1.47	24	557+	43
Non-forested .....	.53	16	828+	95

The most striking feature of this table, as compared with the previous one, is the uniformly large run-off as compared with the rainfall. This clearly shows the enormous amount of water taken up by a dry soil, either forested or non-forested, as compared with one already nearly filled to saturation. During the three months here noted on the forested basins about three eighths of the rainfall appeared in the run-off, while on the non-forested area nineteen twentieths appeared in the run-off.

Rapidity of Decrease in Run-off after the Close of the Rainy Season.

Condition as to Cover.	Area of Catchment Basin.	Precipitation.	April Run-off per Square Mile.	May Run-off per Square Mile.	June Run-off per Square Mile.
	<i>Sq. Miles.</i>	<i>Inches.</i>	<i>Acre-feet.</i>	<i>Acre-feet.</i>	<i>Acre-feet.</i>
Forested	0.70	1.6	153—	66—	25—
Forested	1.05	1.6	146—	70—	30—
Forested	1.47	1.6	166+	74—	30+
Non-forested .....	.53	1.	56+	2—	0

The above table clearly shows the importance of forest in sustaining the flow of mountain streams. The three forested catchment areas, which during December experienced a run-off of but 5 per cent of the heavy precipitation for that month

and which during January, February, and March of the following year had a run-off of approximately 37 per cent of the total precipitation, experienced a well-sustained stream flow three months after the close of the rainy season. The non-forested catchment areas, which during December experienced a run-off of 40 per cent of the rainfall and which during the three following months had a run-off of 95 per cent of the precipitation, experienced a run-off in April (per square mile) of less than one third of that from the forested catchment areas, and in June the flow from the non-forested area had ceased altogether.

A less tangible effect of denuding catchment areas and one that escapes general observation is based on the physical law of capillary attraction. The compacting effect of falling rain, together with that of wind and sun, causes the upper layers of soil to harden and effects the formation of numerous capillary tubes, along which whatever water reaches underground retreats is carried to the surface by capillarity, where it is evaporated. The ground cover of forested land prevents these tubes from reaching the surface by keeping the upper layers of soil loose, as previously explained. Agriculturists recognize the losses from this cause and cultivate frequently to break up the tubes, exactly as a leaf mulch prevents their formation.

With these facts in mind the reason why reclamation engineers insist upon forested watersheds as a primal condition of dam construction is readily understandable. Just now California is looking to the Reclamation Service to install systems of irrigation, and upon the results of the work done within the next few years the growth of the State will depend in great measure. And in this connection it should not be overlooked that neither the Reclamation Service nor the State of California can maintain successful irrigation if fires are allowed to effect the frequent denudation of important watersheds. The willingness of both parties to spend money for this purpose is not sufficient; certain favoring conditions must be maintained or no permanent achievement will be possible.

THE FUNCTION OF THE STATE.

These facts form the basis for State concern, for, unlike the individual, who is interested in the welfare of his industry during his own lifetime only, the State must insure the perpetuity of all industries for succeeding generations. The pioneer epoch has always been marked by the squandering of resources with a wanton disregard for future needs. But as settlement progresses, attended by the establishment of industries requiring permanent sources of material, the period of exploitation is succeeded by that of utilization, gradually becoming more intensive, and in this tendency toward conservatism organized society precedes the individual. How often do we see the inclinations of the individual curbed when the common good is endangered!

Likewise, when the followers of any industry pursue their occupation

to the point which endangers dependent industries it becomes the duty of the State to determine which industry shall survive or take restrictive action favoring the weaker which will permit both to continue. By extending this conception of governmental function somewhat it may be quite as firmly stated that the State's duty does not end when it becomes the arbiter of present generations; it is likewise the guardian of the rights of future generations. Its policy must be planned along broad lines to secure the welfare of all generations and the perpetuity of all industries by conserving the natural resources upon which these industries depend.

According to this postulate what attitude should California assume toward her forest resources? Manifestly it would not be just to legislate against the followers of the lumbering industry unless it could be positively foreseen that their methods, if unchanged, would wreck other industries equally dependent on the forest. Moreover, such action would arouse protest on the ground of restricting personal liberty, besides having a baneful effect on individual initiative. The extent of forest removal, for the present at least, must be determined by the economic law of supply and demand.

Without imposing any restrictions on the amount or methods of cutting, however, the State may prolong the life of her forest resources by effective legislation against the careless use of fire, assuming, in behalf of her continuing interest, some responsibility in the protection of forest property.

ACTION BY THE STATE.

Realizing something of the disaster invited by allowing wholesale forest destruction without replacement, and particularly the ravages of fire to go unchecked, as early as 1885 the State, preceding any other in this particular, passed an Act entitled "An Act to create a State Board of Forestry, and to provide for the expenses thereof." This State board, which was functionally a bureau of education, was endowed with police powers in 1887 and given an appropriation of \$29,500 for salaries and expenses. Three botanical reports were issued by the Board, which at first did faithful work. Later, however, it succumbed to political influence and was abolished in 1893. Under this Act the first and only forest experiment stations in the United States were established at Chico and Santa Monica. When the Act was repealed these were transferred to the Agricultural Department of the University of California.

From 1893 to 1903 forestry in California was at a standstill, yet this period was one of marked need and of rapid development along other lines. It was the decade during which the lumbermen from the Lake

states and Southern pineries flocked to California to invest in timber lands, and during which time California disposed of the bulk of her sole forest possessions by the sale of school lands at the ridiculously low price of \$1.25 per acre. Similarly it was the period during which land fraud flourished, whereby much of the public timber land in California was lost to the National Government and the State.

In 1903 sentiment in favor of forest preservation was expressed in a different and more practical form when the Legislature provided for a thorough investigation of the forest resources of the State by the Forest Service, the expenses of which were to be borne equally by the State and Federal governments. A detailed account of the work done under this contract forms a separate chapter in this report.

Based on the studies of the fire problem and the recurring expressions of sentiment for forest preservation as shown by earlier legislation, an Act was passed by the Legislature in 1905 "to provide for the regulation of fires on, and the protection and management of public and private forest lands within the State of California, creating a State Board of Forestry and certain officers subordinate to said board," etc. An appropriation of \$17,600 was made to defray all expenses incurred under this Act for two years.

THE FEDERAL FOREST RESERVES.

During the decade of State inactivity in forestry the Federal Government instituted its policy of reserving for the purposes of forest production such portions of the public domain as proved, on expert examination, to be of greatest use for that purpose. The needs of California were considered among the earliest states, as practically shown by the creation of San Gabriel forest reserve on December 29, 1892. During the succeeding interim the number of reserves in California has been increased to twenty, aggregating 18,877,110 acres. In the examination and location of reserves the utmost care has been exercised, so far as possible, to include only actual forest land which, by its location, is of particular importance in protecting streams of present or future value for irrigation. As a consequence, the reserves cover the high Sierras and their continuations where the streams of the San Fernando and San Bernardino valleys have their sources.

Each reserve is patrolled by mounted men to prevent fires and administered by a local officer to maintain its greatest usefulness to the industries affected. California need feel no anxiety lest its interests there are not subserved. On the other hand, all energies should be directed toward aiding the Forest Service in its task of protection, for it is a well-known fact that more than half the damage to reserve resources is caused by fires entering from adjacent, unprotected areas.

A desire to coöperate with the State in preventing fires has led the Forester to direct that supervisors and rangers on the several reserves accept appointments as fire wardens. On numerous occasions rangers have left their districts to extinguish fire burning on private land, even when the reserve was not in particular danger. Moreover, their independence of local factions has enabled forest reserve officers to be of especial aid in apprehending violators of the laws and securing their conviction. Nearly half the convictions secured are due to their efforts.

COOPERATIVE WORK BETWEEN THE FOREST SERVICE AND THE STATE.*

By an Act of the Legislature, passed in 1903, the State Board of Examiners was empowered to enter into a contract with the Forest Service of the U. S. Department of Agriculture, for the purpose of investigating the forest resources of the State, determining the best means of conserving them, and formulating a State forest policy. By the same Act, \$15,000 was appropriated for carrying on the work the first two years, with the provision that the Forest Service should contribute a like amount. This contract has been twice renewed since the conclusion of the first two years, with an additional appropriation of \$5,000 by both the State and the Forest Service for each succeeding year.

Actual work in the State was begun by the Forest Service July 1, 1903. The coöperative work is, therefore, now in its fourth year and sufficient time has elapsed to make it possible to point to results, although certain lines of work are as yet incomplete.

General Lines of Work.

The contract outlines in a general way the lines which the work has followed, namely: A determination of the character and extent of the State's forest resources; the best methods of conserving them, and the formulation of a State forest policy.

For all of the above-mentioned purposes the first step necessary was the acquiring of a knowledge of the general condition and extent of the forests of the State. Accordingly, an examination of 21,000,000 acres of forest and brush land was made. This included the North Sierras, the Sierra Nevadas, Southern California mountains, and the greater part of the redwood belt. The work included also a general classification and description of the forest by types and a description of the timber resources by counties. As a result of the work a forest map of the State was prepared, showing the extent and location of the commercial forest, woodlands, and brush lands.

*By A. W. Cooper, Forest Service.

One of the most interesting questions in the preservation of the forest, both to the State and to private lumbermen, has been the protection of the forest lands from fire. This has been the subject of an extended investigation into the character, causes, and extent of forest fires, the purpose being to devise both general and special measures for checking them and preventing their occurrence. This investigation revealed the fact that the prevalence of fires might, to a great extent, be attributed to the non-enforcement of the State fire laws. The methods best adapted to fire prevention on individual tracts were found to be by patrol, fire lines, and the disposal of slash on logged lands.

In Southern California the question of water supply is all important and bears a close relation to the forest cover. On this account two more or less related lines of work were undertaken in the southern mountains. The first was a study of the chaparral or brush areas for the purpose of determining the possibility of their natural reforestation and their relation to the water supply. This study was later extended to similar areas in the northern part of the State. It revealed the fact that a brush cover is a very good conserver of moisture in the absence of a tree cover, that natural reforestation of such areas is a very slow and at best uncertain process, only taking place at all where fire is kept out for a long period, and that fire is the chief factor in the formation and spread of such areas.

The second study in this connection dealt with the reforestation of important watersheds by planting. Here the conclusion was reached that planting on the Southern California mountains, except in favored localities, will be a very expensive undertaking and of doubtful success, but that a careful choice of species for planting may make gradual reforestation possible in portions of the mountains.

State Forest Policy.

As a result of these general lines of investigation, which occupied largely the first two years of coöperative work, measures were formulated which, it was believed, the State should embody in its forest policy. These measures were submitted to the Legislature in the form of a bill, in the winter of 1905, and led to the Act of March 18, 1905, which revised the fire laws and created a State Board of Forestry and the office of State Forester.

Commercial Tree Studies.

While the general work already outlined was in progress a number of special lines of work were started. Among these were a number of commercial tree studies, the purpose of which was to provide accurate data regarding the habits and growth of the more important commercial trees, with the object of securing their continued presence in the forest

by interesting timber owners in adopting methods of lumbering favorable to their reproduction. Studies of this sort were made of sugar pine, yellow pine, and white fir. A similar study had been made of redwood previous to the commencement of the coöperative work.

These studies showed that the rate of growth and character of the various species made them well adapted to conservative lumbering and the securing of successive crops of timber.

Studies somewhat similar to the above were made of eucalyptus and of tanbark oak. The eucalyptus study included the collection of growth figures from the principal eucalyptus groves, as well as estimates of the yield and the financial returns from planted eucalyptus in various localities. As eucalyptus is an introduced tree, the question of its propagation and extension was also important, and the study has dealt thoroughly with these points and with the uses and commercial value of the different species. It became apparent early in the study that the genus was one of increasing importance and great future value in sections of the State climatically adapted to its production. This led to the establishment by the Forest Service of an experiment station at the University of California for the purpose of testing the mechanical and physical properties of the different species of eucalypts, particularly in relation to their use for special purposes. These tests are still in progress, but have already revealed the fact that eucalyptus closely approaches Eastern hickory in its strength, toughness, and general durability.

Tests to determine the practicability of applying preservative treatment to eucalyptus were also made on fence posts. Creosote was the preservative used, and the tests demonstrated that eucalyptus could be successfully and cheaply treated. Sufficient time, of course, has not elapsed to determine the effect of treatment on the life of the timber.

The study of tanbark oak was botanical and dendrological in its character, but included a thorough study of the tanning industry and the present and future supply of tanbark oak. It showed that the supply now available would last thirty-five years at the present rate of consumption, and that the excellent productive capacity of the tree made the outlook for a continued supply excellent, provided a few simple measures were adopted in cutting the present crop.

Other Special Studies.

As a knowledge of the methods and cost of lumbering and of the lumber market in general is essential to perpetuate the forests, a study of lumbering and the timber market was made for all of the important commercial species of the Sierras. The study dealt with the relation of supply and output in different lumber centers and the extent and

effect of outside competition, as well as with the different steps in and the cost of manufacture. The whole study has been an additional argument in favor of conservative lumbering.

Next to fire the most important question in the protection of California's forests is grazing. Therefore, this has been the subject of a separate investigation for the purpose of determining the effects of grazing on the forests and on watersheds and what regulations were necessary to prevent damage to both. The results of this investigation have been largely embodied in the present grazing regulations in force on the Federal reserves within the State.

At the request of the State two other special pieces of work have been undertaken. The first of these was the estimate and appraisal of the Calaveras grove of big trees, which was made pending the event of its purchase either as a State or National Park.

The other piece of work was the investigation of the amount and character of the State's delinquent tax lands. This investigation revealed the fact that nearly 500,000 acres of land in the forest regions of the State are delinquent and that the operation of the present tax laws are often defective, in that they virtually place a premium on delinquency and delay the acquisition by the State of a clear title.

The lands involved were found to be scattered in small lots, and a large part of them were within the boundaries of the Federal forest reserves. A system of exchange between the National and State government was, therefore, suggested, by which the State might consolidate its holdings, and, if desirable, establish State reserves.

Assistance to Private Owners.

The fate of the lumber supply in California depends in no small degree upon the lumbermen, who own a large portion of the State's forested area. It was recognized early in the work that practical examples of protection, conservative lumbering, and planting were the best means of arousing the general interest of lumbermen and private owners in these questions.

Plans for fire protection were accordingly prepared for a tract of 80,000 acres in the Sierras belonging to one of the large lumber companies of the State. A system of patrol, telephone lines, trails, and burning the slash on logged areas formed the basis of this particular plan, which was later extended to include marking trees for cutting.

Another plan for a still larger tract in the North Sierras had as its basis a system of fire lines for protecting the young growth; it also included a patrol, telephone lines, tool stations, and slash burning, and was later extended to cutting timber to a diameter limit. Both of these plans are in successful operation. A number of planting plans, for both large and small tracts and in one or two instances for city watersheds, have also been prepared from time to time.

Work in Progress.

As has been stated, certain lines of work have not been completed. The chief object of the coöperative work has been accomplished in the establishment of a State forest policy; but in order that the State work may be on a firm basis, with room for growth, it is necessary that the State Forester be amply provided with data and information on the character and resources of the State's forests. Such data are in large part received already, and all that remains is to round this out as much as possible. For this purpose one or two lines of work begun in former years are being extended. The study of eucalyptus and the tests on the timber are still in progress. The study of planting has been extended to the whole State, so as to include both agricultural and forest lands. This work is now nearing completion and it is hoped that the results can be embodied in a planting manual for the State.

An investigation of cut-over forest lands was begun this year, the purpose of which was to determine the extent of such lands, their present condition and use, and the attitude of the owners of such lands toward them. On this information it will be possible to base suggestions for their future improvement and disposal. The study of lumbering and market conditions has been extended to include the redwood belt.

The results of the past coöperative work between the State and the Forest Service have been embodied in some seventeen comprehensive reports and maps and in about forty-five special papers, most of which are now in the hands of the State Forester. A few of the results have been published by the Forest Service and others will be published from time to time.

REVIEW OF STATE FORESTRY WORK.

On July 12, 1905, a State Forester was appointed and actual forestry work begun by the State. Recognizing that relative security against fires is of paramount importance in determining the feasibility of forestry, all energies were directed to this end. And in this connection education and publicity were emphasized rather than rigid enforcement of the penal sections, both because no machinery for the latter could be secured without approval of the public, expressed by coöperation, and because it was deemed unwise to imperil the popularity of the movement, particularly in the beginning. Accordingly correspondence, calling attention to the State's forestry work, in the form of personal and circular letters, pamphlets, newspaper articles, etc., was commenced with all manner of organizations from San Diego to Siskiyou. The results quickly showed that the public was ready to assist.

The efforts of the State Forester to awaken interest in the sections providing for county coöperation were ably seconded by powerful

organizations in all quarters. The Water and Forest Association continued the yeoman service it had performed in urging legislation to induce county boards to cooperate. The California Promotion Committee displayed its interest by making the State Forester a member of its advisory committee. Boards of trade and chambers of commerce throughout the State expressed a willingness to aid, while associations of lumbermen, stockmen, miners, and water-users were quick to volunteer. Independent lumbermen, ranchers, stockmen, and others throughout the State sought appointment as fire wardens, ignoring the fact that no compensation accompanied it, simply to protect their own and their neighbors' interests. Favorable action by county supervisors, however, did not follow without an appeal from the State Forester in person, and often not then.

As a result, largely on account of the lateness of beginning forestry work under the new law and the imperative demands made on the time of the State Forester by preliminary work, the season of 1905 closed with Santa Cruz County the only one pledged to cooperation. During the winter agitation was continued untiringly, with such encouraging results that on the opening of the fire season of 1906 immediate attention was given to several counties that were practically prepared to fall in line. As a consequence, the support of four more counties had been secured by June 30, 1906, when the resignation of the first State Forester occurred.

Since that time the established policy of the office has been consistently pursued. No work, however important, has been allowed to prevent attendance at the meetings of county supervisors, where every possible argument has been used to secure support. Twenty-three boards have been interviewed, some two or three times when hopes of ultimate success seemed to warrant it, and five counties have been added to the list, making a total of ten. In personal justification it must be added that this number is in no proportion to the effective work done and doubtless considerably smaller than it would have been had the season been less disturbed politically. In more than one case a single opposing member has effectively prevented favorable action by boards when the other four were willing to ordain in favor of the ordinance presented. In other cases failure has resulted when a petition signed by a majority of prominent taxpayers has been submitted to prove the favor of the people. As an instance of the apathy of county officers may be cited the case of one board in the San Joaquin Valley which has failed to recommend a single citizen for appointment as fire warden, in spite of several insistent requests from this office since the passage of an ordinance in August appropriating \$500 for this purpose. From a neighboring county, where an identical condition obtains, names have been received from but one supervisor.

Coöperative work with landowners for forest replacement has been commenced, but little can be done at present, owing to lack of technically trained assistants. If the State were equipped for the work much good could be done, for the Forest Service has recently changed its coöperative offer and now requires that landowners pay both the salary and expenses of its agents. Formerly only the expenses were asked, and often not even them.

During the summer a patrol force of six men has been maintained by the State Forester on the proposed Stony Creek reserve. This force was supported by a joint appropriation made by Glenn and Colusa counties and the Stockmen's Defense Association for the purpose of protecting the area from fire pending its re-examination by the Forest Service. The results showed plainly the efficacy of patrol, despite the fact that the patrolmen were collected hastily and without much choice.

Through circular letters to lumber companies valuable data have been gathered on the annual cut of various species and the attention given to fire prevention. These reports show that but very few of even the best equipped companies take any steps to protect their standing timber.

ATTITUDE OF THE PUBLIC.

As was expected, recognition came first from the element which was responsible for the passage of the laws: organized forest and water interests, outdoor clubs, students of political economy, and forestry enthusiasts; these needed no convincing and gave their aid immediately in more or less practical ways. The test, however, is the response from other classes, particularly those whose support was needed to give the movement practical results. While the test is still in progress, it has been quite satisfactory so far. Indifference still prevails in some quarters; passive approval with small results in others; but indorsement is the rule. In no case has there been an unfavorable demonstration.

Attitude of Lumbermen.

The more practical lumbermen regarded the step critically at first. Believing in the object sought, they waited to see the methods employed. They knew the need for checking fires, but feared State forestry meant something less practical, if, indeed, not a direct attack on their own freedom. Some enthusiastic nature-lovers, who call their tenets forestry, are not charitable to lumbermen, so the latter waited to see the State's interpretation.

A few months showed a visible change, and a year a most decided one. The California Sugar and White Pine Agency, the most powerful lumber association in the State, offered its facilities and has been of much assistance. Independent lumbermen throughout the State,

through constant correspondence with the State Forester, are of mutual assistance. Judging from the progress already made it can be safely predicted that close coöperation, instead of random effort, between the State Forester and members of the lumbering industry to reduce the damage from fires is an attainment soon to be realized. In this connection it can not be emphasized too strongly that *organized* effort on the part of all industries concerned is the only practical way to cope with forest fires.

Attitude of Kindred Organizations.

Not only the Water and Forest Association, but numerous power and irrigation companies have given indorsement and substantial help in many ways. The California Promotion Committee, representing all commercial organizations, recognized the business importance of the office and passed strong resolutions indorsing the work and urging counties to coöperate. Boards of trade, chambers of commerce, and women's clubs have taken similar action. Stockmen, miners, land-owners, and water-users have all come to see that for the first time means exist by which they can get protection for their property, and are availing themselves of it.

Attitude of County Supervisors.

It can be stated at the outset that the personal attitude of county supervisors has been favorable without a single exception. Unfortunately, however, a favorable personal attitude does not always predicate official approval. Some boards are prevented from acting by the poverty of the counties they govern; others object to the provision that the State shall receive the fines collected, saying the State is imposing a burden on the counties to increase her own revenues. These arguments are doubtless well grounded.

Frequently those who are unused to organizations contend that volunteers appointed to act individually without pay or direction are quite as effective as a system supported by county appropriation. Some hesitate to approve such an innovation, fearing lest it react to unsettle their political security, while others plead for a month in which to consider it. It is safe to say that no argument will prevail in such cases, for the vision of such men is so circumscribed politically that their best attempts at evasion amount to begging the question.

Throughout the southern part of the State and the more enlightened counties of the San Joaquin Valley, however, the desire for protection and the prosperity of the counties has overridden the arguments of the first class, while those of the second have been deemed unworthy. Even here the attitude of the State has been deprecated, however, in spite of the fact that coöperation has been secured.

It can not be gainsaid that the conditions under which the State offers "coöperation" (which is a misnomer, for there is actually no coöperation, since the State retains all authority but accepts no responsibility) leave abundant room for objection, if personal or political reasons prompt the supervisors to make them.

Attitude of Magistrates.

According to Section 12 of the forest law, magistrates with proper authority must prosecute all cases brought to their attention with diligence and energy, under penalty of fine. In the actions of these officers the attitude of the supervisors is reflected very clearly. If the supervisors favor coöperation by appropriating the county's funds, the district attorney needs no urging to prosecute violators of the laws. If, on the other hand, supervisors evade coöperation the district attorney seeks legal subterfuges why prosecution should not be attempted. Of course, the position of the magistrate is so untenable usually that prosecutions might be secured by pressure, although it must be admitted that the probabilities of securing convictions through the agency of an unwilling officer are rather poor, while the chances would be that the county would be antagonized by being forced to accept an unsought burden to the extent that ultimate coöperation would be impossible. While no flagrant violation has been allowed to go unpunished, considerations of expediency have somewhat modified the State Forester's actions, for it has been fully realized that the present law is not perfect enough to stake the popularity of the forestry movement on. For this reason and because the ethical position of local officers has often been sound, forbearance has been the watchword.

Attitude of the Press.

The hearty coöperation of the press of the State is especially gratifying. Without a known exception favorable comment has followed every hampered attempt to enforce the laws. Many editors have voluntarily urged county supervisors to coöperate with the State for protection, both by commenting favorably on the action of other counties and by editorials. Many more have cheerfully given space for the publication of information of very general nature. It is safe to say that the activities of no other single department of the State receive more extended comment.

TECHNICAL FORESTRY.

Despite the fact that the Act contemplates the development of technical forestry in California by advice to landowners, and provides specifically for the preparation of plans for replacement and management of forests, the work of the first year included no aid of this kind.

This was largely due to the fact that the time of the State Forester was occupied in other ways and to the lack of assistants. Henceforth outside the fire season the policy will be to extend all possible assistance to applicants for expert advice.

In accordance with this policy a planting plan for the Union Lumber Company, Fort Bragg, California, is now in preparation. Although the basic data have not all been gathered, the object of the plan is to furnish complete directions for the formation of an eucalyptus plantation on unused portions of a cut-over redwood tract. The company has virgin supplies sufficient for several decades' cutting, and aims, on the exhaustion of these supplies, to have material grown for further operations.

Two other applications have been received recently. One for the establishment of a protective forest on an important watershed in Fresno County; the other for scenic planting on a large tract in Santa Cruz County. These applications will be attended to as time permits.

Beyond distributing copies of the forest laws, absolutely no publicity has been given the State's coöperative offer, for two main reasons: First, the low statutory salary allowed assistants does not permit the securing of technically trained men, hence all technical work devolves on the State Forester; and second, it is certain that the issuance of this offer would immediately invite so many applications that but few could receive attention.

The warm, equable climate prevalent throughout the greater part of California presents conditions, possessed by no other State, for the rapid production of many species of eucalypts. In the past the blue gum (*E. globulus*) has been planted more extensively than any other species, but mainly for windbreaks and fuel. The recent experiments with this species, made by the Forest Service in coöperation with the State, show that its mechanical properties are not unlike those of second-growth hickory. This fact has directed attention to the possibilities of growing it for furniture, implement and wagon stock, etc.

Experiments have also been made which prove that this species can be impregnated with a preservative very simply and cheaply. Time enough has not elapsed to show the comparative length of life of treated and untreated timber, yet judging from the known effects of preservatives on other species it is safe to predict that the life of treated timber will be multiplied two or three times. If this is the case the near future will see extensive plantations of eucalyptus for the production of railroad ties, fence posts, telephone and telegraph poles, piles, etc. The Santa Fé Railroad Company has recently purchased a ranch of 8,330 acres near San Diego, where it will produce material for its own use.

While a great deal of attention has already been given the production of blue gum, very little has been devoted to other species. The sugar gum (*E. corynocalyx*), while of somewhat slower growth than the blue gum, produces a much more shapely bole, especially for tie, pole, and post use, and will thrive with less moisture. Under proper care in the beginning there seems no reason why extensive plantations of this species should not be made over the lower foothills. Many other species of eucalypts deserve attention.

Another possibility worth considering is the establishment of the naval stores industry in California. By the introduction of the "cup and gutter" system in the southern pineries the Forest Service has completely revolutionized the methods of turpentine. Under the new system the damage to the forest has been reduced to a minimum, and at the same time the product has been increased over 25 per cent. Recent analysis of crude resin collected from California give from 20 to 22 per cent of turpentine, which is 1 or 2 per cent above the average yield from the standard turpentine pines of the South.

COUNTY CO-OPERATION.

As stated elsewhere, there are ten counties coöperating with the State for fire protection. These are San Diego, Riverside, San Bernardino, Los Angeles, Santa Barbara, Kern, Tulare, Fresno, Santa Cruz, and Tuolumne. They deserve all credit for willingness to do what the law permits.

According to the plan most generally followed the county supervisors appropriate from the general fund a sum sufficient to pay citizens 25 or 30 cents an hour for actual services performed in extinguishing fires. The amounts appropriated vary from \$500 to \$1,000, depending on the size of the county and its financial condition. The supervisors then recommend such citizens for appointment as fire wardens as they desire, and on this recommendation the men are immediately appointed. Each fire warden is furnished with a badge, book of burning permits, a supply of law circulars for distribution, and a number of warning notices for posting.

Another plan, followed by Los Angeles, Santa Barbara, and Santa Cruz counties, is to increase the salary of the game warden and make him chief fire warden, with patrol duties. The chief fire warden then recommends the names of citizens whom he wishes appointed.

Of the two plans the latter is by far the more effective, because there is then a man who has partial control of the system and some sort of organization results. Where fire wardens are appointed at the request of supervisors, absolutely no organization is secured. A fire warden works or not as he wants to, and submits his bill to his super-

visor for payment. The State Forester has absolutely no control over either system, can give no aid except on request, and offer only suggestions, which the fire wardens may follow or not as they choose. Usually the posting of warning notices is the only attempt made to prevent fires. If a fire occurs in a grain field or pasture, vigorous efforts are usually made to check it. This is no advance, however, for property owners did this before the office of fire warden was created. If chaparral on a watershed is burning little attention is paid to it, for few understand its importance.

To sum up, neither system does harm and may do good, depending entirely upon the personal equation of the fire wardens. This is exactly what must always be expected from lack of organization.

In the matter of arrests the systems are even less satisfactory. Usually fire wardens are engaged with other duties and know nothing about a fire until it has a good start and the one who caused it, if a hunter or camper, has had ample time to escape. If caused by a resident on friendly terms with the warden, the offense is overlooked. Should their relations be strained for any cause, however, an arrest usually follows, after which a conviction depends entirely upon whether the offender will plead guilty. If not, the warden is usually too busy to collect evidence, and the case is dropped. In other words, personal considerations usually determine the action taken.

Moreover, the provisions of the laws militate directly against the interest of magistrates. No county magistrate can be expected to involve the county in expense to collect a fine which must be forwarded to the State. If a flagrant case is called to a magistrate's attention, and no excuse exists for failure to prosecute, he ordinarily takes the action commanded by law. If any excuse exists, or can be created, the case is overlooked. Here both personal and political considerations determine results.

To sum up, county coöperation is about the weakest possible excuse that can be conceived for an organization in any way capable of securing immunity from fires. And it will continue to be so long as the county is required to do, unaided, work which benefits both the county and State. Any attempt on the part of the State to urge county officials to greater efforts immediately strengthens their aroused suspicions that the State wants more money from fines. Before anything resembling satisfactory protection is secured the State must assume equal expense with the counties, share the fines equally, and retain the right to direct the work of salaried men with no other but warden's duties. The forest bill appended to this report differs from the present law principally by providing patrolmen. Too strong emphasis can not be placed upon the fact that unless this machinery for enforcing the laws

and preventing fires is secured the usefulness of the State Forester will soon end. County coöperation under present conditions is intolerable.

The State can exercise the control which its duty demands only by amending the laws and making financial provision to insure protection. At present the State Forester can not incur expense to prevent and extinguish fires, even in emergencies and where such action would go far to strengthen public approval. He can not hire a man to enforce the punitive laws, although failure to enforce them frequently results in contempt and disbelief in their force and efficacy. Even the very cost of trial and punishment must be borne wholly by the counties. In effect, this means that the State has recognized its duty to the extent of imposing certain laws on the counties without their consent, but stopped there, and not only left the entire burden of prosecuting on them, but expected them to voluntarily increase this burden by paying fire wardens to hunt up trouble. It may be contended that the same is true with regard to other penal laws, but there are two differences: the counties are expected to maintain a fire warden force in addition to the ordinary judiciary machinery, and they are not permitted to retain the fines collected.

FOREST FIRES.

Before discussing the principal causes of forest fires or the means of preventing them, it will be instructive to consider briefly their effects on the following classes of land:

1. Virgin forest land;
2. Culled forest land;
3. Clean-cut forest, or brush land.

On virgin forest land fire destroys all ground cover and reproduction, and in the case of a top fire destroys even the larger trees. A slower fire will burn through the bark at the base of the trees, in the case of firs and pines, and destroy the cambium, thus killing the tree. In redwood usually the second or third fire succeeds in getting through the bark and burning out what is known as a "goose pen" in the base. If there is a draught, or if the tree is hollow, the heart is burned out and a chimney results. In any case a high percentage of such timber must be rejected in lumbering, if, indeed, not all of it. Moreover, the destruction of the young growth delays for a long period or prevents entirely the starting of a second crop, depending on the extent of the fire and the proximity of unburned areas from which seeds may come.

On culled forest land the soil and humus covering is burned from the bases of the remaining trees and they are thrown by ensuing winds. The possibility of their seeding up the area is thus precluded. All small growth is consumed, together with the débris left from lumbering, leaving the soil exposed to erosive action. The fertile surface soil is

generally lost before chaparral species have a chance to enter and prevent further erosion. Once the chaparral has secured possession the chances that a forest growth will follow are very meager, indeed.

On clean-cut forest or brush land the damage is entirely to the watershed. This consists first in the loss of all vegetable covering of the soil, and, second, the erosion of the soil itself. Successive fires effect the removal of all soil, so that the rock is exposed and no further chance remains for even the hardy chaparral species to cloak the ground.

Causes of Fire.

Data on the principal causes of forest fires have been gleaned from 120 reports made by fire wardens in twenty-three counties during the past season. While such a limited number of reports from one season are not sufficient to establish reliable percentages, they will serve to indicate the principal sources of forest fires.

Cause.	Number.	Per Cent.
Sparks from engines.....	17	14.18
Clearing land.....	12	10.00
Camp fires.....	12	10.00
Lightning	10	8.33
Maliciousness	5	4.16
Logging	3	2.50
Unknown and *miscellaneous.....	61	51.02
Totals	120	100.00

Occurrence of Fires.

The percentage of fires by months is also interesting in this connection.

Month.	Number.	Per Cent.
May	2	1.66
June	11	9.17
July	31	26.31
August	35	29.15
September	18	15.00
October	22	18.34
November	1	.83
Totals	120	100.00

Fires burning 1,000 acres or more have occurred as follows:

Month.	Number.	Estimated Area Burned (Acres.)
June	1	1,000
July	5	7,480
August	3	42,100
September	6	54,900
October	7	44,840
November	1	2,000

*Includes dropping lighted matches, cigars, cigarettes, fire crackers, sulphuring, etc.

While these data are very incomplete, particularly as regards the northern counties, reports showing the destruction of 650,000 acres outside the forest reserves have been received. Without considering the loss of material more valuable than watershed cover, one can readily see how necessary it is to reduce this annual loss to the State. In many cases, however, valuable timber has been lost, crops have been burned, cattle destroyed, and homes swept away, which men have spent years in accumulating.

Prevention of Fires.

Forest fires should be prevented just as any other crime against society, namely, by enacting laws restricting the dangerous use of fire under penalty, and by employing officers whose sole duty it is to see that the laws are obeyed. The State has taken legislative action in this direction, but has failed to provide executive machinery. Until this is done the forest laws will remain unused, except in particularly flagrant cases. Experience has proven adequately enough that other laws are not automatic. Why should the forest laws be an exception?

Moreover, there is no logical reason to expect men throughout the State to accept appointments as fire wardens and fulfill the prescribed duties when such action will cause trouble to a neighbor. It has followed in practically every case that men so appointed have performed yeomen service in distributing circulars containing the laws, in posting warning notices, and in fighting fires, but seldom has one been found who will cause his neighbor trouble. This is readily understandable when one considers that the desire for the esteem of one's fellow men is one of the strongest factors determining human behavior. Furthermore, the daily duties of voluntary fire wardens preclude the possibility of their giving attention to preventing fires. One is rarely found who will not use every effort and even incur personal expense, besides loss of time, to extinguish one already burning, but prevention is not emphasized, except as the law circulars distributed and the warnings posted increase public caution.

FIRE WARDENS.

There are 367 citizens in the State who have accepted appointments as fire wardens. Of these, 136 are volunteers, 128 are employed by the Forest Service, and 103 are paid by the counties in which they reside for actual services performed in extinguishing fires.

When appointed, every fire warden is required to take an oath of office, which in California costs him 50 cents. Thus it will be seen that the volunteer wardens and those employed by the Federal Government have actually paid for the privilege of being fire wardens, for which

they can receive no compensation. Does the State appreciate **such** loyal service? County wardens also deserve great credit, for they are paid only for time actually spent in fighting fire, though most of them devote a considerable amount to posting notices, for which there is no compensation. The fire wardens are located as follows:

County.	Number.	County,	Number.
Alameda	14	Placer	5
Butte	17	Plumas	12
Calaveras	4	Riverside	14
Colusa	1	Sacramento	2
El Dorado	3	San Bernardino	38
Fresno	7	San Diego	33
Glenn	3	San Joaquin	1
Humboldt	2	San Luis Obispo	8
Inyo	1	Santa Barbara	14
Kern	25	Santa Clara	3
Lake	2	Santa Cruz	13
Lassen	1	Shasta	4
Los Angeles	45	Sierra	3
Madera	8	Siskiyou	21
Marin	2	Sonoma	10
Mendocino	1	Tehama	2
Modoc	6	Trinity	9
Mono	2	Tulare	8
Nevada	11	Tuolumne	6
Orange	1	Ventura	5

Although it is unreasonable to expect unpaid men to display **much** activity in extinguishing fires which do not endanger their own lands, fire wardens have done good work on 76 of the 120 fires reported.

ARRESTS AND CONVICTIONS.

From the following list an idea can be gained of the attempts made to enforce the punitive laws and the localities most active in this respect. The preponderance of arrests in San Bernardino County is not an index of greater criminality there, as might be supposed at first glance, but of the energetic efforts of the Forest Supervisor, backed by public sentiment. The names of the offenders are withheld.

No.	County.	Law Violated.	Magistrate.	Action.
1	Calaveras	Stats. 1905, Sec. 16 ..	Justice Marsh	Case dropped.
2	Los Angeles	Stats. 1905, Sec. 16 ..	Justice Pierce	Fined \$50. Sentence.
3	Los Angeles	Stats. 1905, Sec. 16 ..	Justice Crawford	Fined \$50.
4	Los Angeles	Stats. 1905, Sec. 14 ..	Justice Crawford	Fined \$50.
5	Mono	Penal Code, Sec. 384 ..	Justice Montrose	Fined \$10.
6	Placer	Stats. 1905, Sec. 16 ..	Justice Hughes	Pending.
7	Plumas	Stats. 1905, Sec. 17 ..	Justice Page	Pending.
8	Santa Cruz	Stats. 1905, Sec. 16 ..	Justice Page	Fined \$50.
9	San Diego	Stats. 1905, Sec. 14 ..	Dist. Att'y Carter	Pending.
10	San Diego	Stats. 1905, Sec. 14 ..	Dist. Att'y Carter	Pending.
11	Santa Clara	Stats. 1905, Sec. 16 ..	Dist. Att'y Campbell	Pending.
12	Siskiyou	Stats. 1905, Sec. 14 ..	Dist. Att'y Luttrell	Case dropped.
13	Siskiyou	Stats. 1905, Sec. 14 ..	Dist. Att'y Luttrell	Imprisoned during earthquake holidays.

No.	County.	Law Violated.	Magistrate.	Action.
14	Siskiyou	Stats. 1905, Sec. 10 ..	-----	Case dropped.
15	San Luis Obispo.	Stats. 1905, Sec. 16 ..	-----	Pending.
16	Sacramento	Penal Code, Sec. 384 ..	-----	Pending.
17	San Bernardino.	Penal Code, Sec. 384b ..	Justice Paddock	Fined \$5.
18	San Bernardino.	Penal Code, Sec. 384 ..	Justice Paddock	Fined \$10.
19	San Bernardino.	Stats. 1905, Sec. 14 ..	Justice Paddock	Fined \$50.
20	San Bernardino.	Stats. 1905, Sec. 15 ..	Justice Belden	Fined \$50.
21	San Bernardino.	Stats. 1905, Sec. 16 ..	Justice Glover	Fined \$50.
22	San Bernardino.	Stats. 1905, Sec. 16 ..	Justice Gifford	Pending.
23	San Bernardino.	Stats. 1905, Sec. 16 ..	-----	Pending.
24	San Bernardino.	Stats. 1905, Sec. 14 ..	Dist. Att'y Sprecher ..	Fined \$50.

As shown above, \$425 has been collected from the 16 cases disposed of. Those pending will probably yield \$200 more.

The minimum fine has been imposed in every case, so far as known. Some hesitancy has been evinced by magistrates to imposing a fine so large as \$50, and had the offenders not pleaded guilty it is doubtful if so many convictions would have been secured. A fine of \$25 is punishment enough for the ordinary violator. This represents a distinct loss great enough to induce caution in future, but does not become a severe burden. For this reason the minimum fine should be reduced to \$25 in Sections 14, 15, and 16.

DESIRABLE CHANGES IN THE FOREST LAWS.

In order to accomplish the ends for which they were designed and become workable, the forest laws should be changed along three distinct lines:

1. Broadened, to include machinery for the enforcement of the legislative provisions.
2. Adjusted, to fit other laws by eliminating portions providing for action already covered by laws previously enacted or portions in direct conflict with provisions of prior laws.
3. Clarified, by avoiding references to subjects not germane to the particular theme under treatment.

The future efficiency of the laws will depend entirely upon whether machinery for the enforcement of the legislative provisions is granted. The last Legislature deemed a period of education a necessary step before commencing active work. That period is drawing to a close and the results of agitating rational forestry are apparent. This report is unnecessary to make the fact known that people in all quarters are taking a more active interest in forestry than ever before, because they understand its aims. Certain lumbermen, who two years ago assumed a helpless attitude toward fires, are now casting about hopefully to find the best means to protect their property. Others who formerly declared fires did little harm and were usually not very destructive now

speak of the enormous loss caused by the destruction of young growth. In other cases the loss of watershed cover is lamented. Mention is made of the lesser volume of streams now than formerly, and the reason for it is recognized. More and more attention each year is being given to the utilization of inferior species and by-products. People are becoming satisfied with poorer grades and smaller dimensions, and timber owners, realizing this, are giving more thought to general protection. Increasing number of landowners are asking advice on planting forests for supplies and protection. In other words, the fundamental steps for the success of the forestry movement have been taken. Further development is necessary in some quarters, but this may safely be counted on to accompany actual work, which should begin while the people are expectant.

To provide immunity from fires salaried patrolmen should be distributed over the State, whose sole business is to prevent and check fires. The State Forester should decide where the greatest need for protection exists, should be given authority to employ patrolmen, and held absolutely responsible for results. This will necessitate the districting of the State and the securing of district fire wardens. It is estimated that twenty can be used at once and more as soon as the results of the work are demonstrated. Only district fire wardens should be empowered to compel assistance in putting out fires. This work should be paid for at the uniform rate of 25 cents per hour, just as men who do similar work on forest reserves are paid. Where counties are large, or the means of travel are primitive, each county should be made a separate district. Under opposite conditions, two or three counties should be grouped. In some cases it may be advisable to ignore political units and follow natural divisions.

Where one county forms a separate fire district it should be assessed one half the cost of patrol and in addition one half the expense incurred by securing assistants to put out fires. Counties now pledged to coöperation will doubtless be glad to abandon the present lax system for a practical plan of this kind. Others, who have looked with disfavor on the old scheme, will fall in line. There will always be a few, however, who will be opposed to any plan. When this condition obtains, yet protection is necessary. The State should be empowered to provide protection and assess the district for its share of the expense. When counties are willing to meet the State half way the net returns of fines collected should be divided equally. But if the county or counties composing a district needing protection will not coöperate, the entire sum collected by fines should be taken by the State.

In addition to salaried patrolmen, reliable citizens desiring the powers of fire wardens should be appointed, but should not be given authority

to compel assistance, except in the case of forest reserve officials. The payment of men summoned by reserve officials will be made by the Federal Government.

To prove the State's belief in its own teachings, executive machinery should be supplied to meet the increasing number of applications for technical advice along the lines of replacement and management. One technical assistant is an immediate necessity for the work.

Certain sections of the Act of 1905 are almost identical with sections of the Penal Code. Hence, local magistrates may choose which law they will follow in prosecuting. This is true of Section 14, which differs but slightly from Sections 384, 384a, and 600 of the Penal Code. Likewise, Section 15 is like Section 384b of the Penal Code and Section 3, Stats. 1875-6:408. To avoid confusion the Penal Code should be amended to include whatever additional provisions are necessary, instead of having certain parts almost duplicated in the forest laws, as at present.

The necessity for clarifying sections to avoid reference to subjects not covered by the Act of 1905 exists particularly in Section 3, where the Mount Hamilton tract and the Chico and Santa Monica experiment stations are alluded to, although none of them are governed by the State Board of Forestry. This ambiguity should be removed, having reference only to California Redwood Park and providing for the administration of any forest tracts which may be acquired later.

These recommendations are incorporated in the proposed legislation appended to this report.

SUMMARY OF CONCLUSIONS.

The effect of settlement and development on the forests of California has been to reduce the area of merchantable timber very materially, leaving the area of actual forest land practically unchanged. The temporary reduction of the merchantable area, caused by lumbering, becomes permanent when lumbering is followed by successive fires, which prevent the reproduction of tree species and cause the invasion of chaparral.

The sale of forest products produces an immense annual revenue, hence forest protection, so that complete utilization may accrue, is imperative.

The denudation of watersheds is always followed by floods and drought. This matter is particularly vital in California, where every other industry is directly dependent on a cheap and abundant supply of water.

The State is the arbiter of present and the guardian of future generations. Its function is to preserve present resources, not only for pres-

ent use, but also for future use. In the case of the forest, it should take effective action to prevent losses by fire.

The State has in the past made sporadic and half-hearted attempts to practice forestry, but with little success until 1903, when a contract with the Forest Service was made for a thorough study of forest conditions and the formulation of a State forest policy. The Act of 1905 was based on conclusions thus obtained, but owing to amendments its usefulness was greatly impaired. As enacted, it amounted simply to a propaganda instrument, without machinery to enforce its provisions.

The attitude of certain elements toward forestry was cordial from the beginning. Others have been won over, until now there is widespread sentiment for forestry practice.

Technical forestry has been commenced, and the possibilities of extensive work are limited only by lack of technically trained assistants.

Ten counties have appropriated sums for the payment of wardens. Others are deterred only by the inconsistent attitude of the State as expressed in its coöperative offer. Owing to lack of control, poor organization has followed and small results have been secured.

The forest laws should be broadened to include machinery adequate to cope with forest fires; adjusted to other laws, and clarified to eliminate ambiguous references.

EXPENSES OF STATE FORESTER'S OFFICE,

July 1, 1906, to October 31, 1906.

Salaries	\$1,695 00	
Traveling expenses.....	710 62	
Printing and stationery.....	402 75	
Postage	83 00	
Office rent.....	57 35	
Incidentals	197 91	
Total		\$3,146 63
Annual appropriation.....	\$8,800 00	
Unexpended balance from fifty-seventh fiscal year.....	4,449 53	
Total		13,249 53
Balance		\$10,102 90

CALIFORNIA REDWOOD PARK.

The California Redwood Park represents a public investment of a little over \$250,000 and a public benefit many times greater. It is the only retreat within easy reach of the population centers of the State that combines unexcelled natural beauty with unrestricted freedom at an expense within the means of all classes of people. Moreover, its benefits, although widely enjoyed now, will attain increasing impor-

tance as urban populations become larger and rural regions become fewer. To meet these growing demands the California Redwood Park must be administered to insure its permanent usefulness by protecting it from destruction by fire and improving it as rapidly as public needs demand.

Protection.

In keeping with this policy, the administration of the park has been directed toward securing immunity from fire before attempting other than the most pressing improvements. About 28 miles of fire lines, varying in width from 30 to 60 feet, have been cleared. These lines now encircle the park, excepting for a distance of approximately $11\frac{1}{2}$ miles, which will be cleared this winter. The fire lines have followed the rim rock of the basin and smaller spurs practically all the way. In places this necessitated clearing on private lands outside the park, in which cases the owners have exhibited a gratifying willingness to aid in the work, both as a public service and because partial protection to their own property resulted. Some have contributed labor and others money toward the work. No fires have crossed the park boundaries during the last two dry seasons.

In constructing the fire lines last year an attempt was made to cover as much ground as possible. As a result, the early work was hastily done and will need to be gone over again. A strip several feet wide was grubbed along both sides of the fire lines, but in the middle the brush was cut but not grubbed, the idea being that when the material piled along the middle was burned the heat would kill the stumps and prevent copice from springing up. This did not follow, however, hence these lines now have a strip of young brush through the middle, on both sides of which the line is open. In some cases, too, the lines were left too narrow in places, owing to the haste to get around the basin. Before these lines are fully satisfactory the stumps will need to be grubbed from the middle and the width of the line increased.

This year it was possible to give more time to the work, and greater permanence has resulted. All species except tanbark oak and redwood have been cut and grubbed from the lines, together with all trees of these two species that were deformed or less than 8 or 10 inches in diameter. The brush has been piled in a windrow along the middle of the line, where it will be burned at favorable times, when dry.

In addition to the fire lines surrounding the park, several short secondary lines from 20 to 40 feet wide have been cut along cross spurs inside the park, to form further barriers in case a fire crosses one of the outside lines. Strict watch over campers and visitors is kept by the warden and other employées, to guard against an outbreak within the park. A supply of fire-fighting tools is kept on hand.

The fire lines are not intended to be automatic, except the fire is slow, but to serve as vantage points along which to fight a fire or from which back-firing can be done safely. When the present system of fire lines is completely cleared of material only unusually fierce fires need cause any great apprehension.

In view of the density and large size of the timber through which the fire lines have been cut, the cost of clearing and grubbing has been moderate at about \$150 per mile. Approximately $18\frac{1}{4}$ miles were cleared during the last fiscal year, at a total cost of \$2,744.90. Those cleared since July 1 have cost somewhat more, because of the greater care taken to render them permanent. At the present time the fire lines are costing close to \$175 per mile.

Future Protection.

The presence of workmen on the rim surrounding the park has obviated the necessity of keeping men stationed at prominent points to give warning of fires from which damage might result. When the fire lines are completed it will be necessary to keep three or four men at work along them during the dry season, to maintain a lookout. Each beat should be connected with the warden's headquarters by telephone, so that he can be warned at once if a fire is approaching. The cost of installing and maintaining this signal system will be very small, for wires can be strung on the smaller trees and the men can be profitably employed in keeping the lines cleared of grass and weed growth. The utmost vigilance will be necessary, during the next three or four years in particular, for several companies owning timber adjacent to the park are about to commence lumbering.

Improvements.

Despite the fact that protective measures have been given first attention, several important improvements have been made since July 1, 1905, when the State Board of Forestry assumed the administration of the park.

Of first importance was the construction of about $\frac{1}{2}$ mile of road from Sempervirens Camp to Flea Potrero, and the widening of the road from Sempervirens Camp to Governor's Camp. This road is from 16 to 20 feet in width at almost all points, and built on a uniform grade not exceeding 6 per cent. Permanent repairs have also been made on two large slides and several small ones caused by heavy winter rains. A thoroughly good job was done in widening the road, making it possible for teams to pass at almost any point.

The permanent buildings at the park have been increased by the erection of a substantial log barn at the entrance and a combination tool and bunk house at Governor's Camp. The former was built of unhewn

redwood logs of uniform size, and has been much admired by visitors. The latter, although less elegant in appearance, has supplied a needed shelter for tools and employés.

Several new trails and improvements to old ones have opened up the park to such an extent that visitors stopping several weeks in the park always find new places to visit. Considerable work of much importance, although less noticeable, has been done to rid the camping sites of dead brush, fallen limbs, and poison oak.

At the present time two important jobs are under way. One is the construction of a private telephone line from Boulder Creek to Governor's Camp; the other, a survey of the park boundaries. The telephone will supply a long-felt need for communication with neighboring towns, for assistance in case of fire and for the use of visitors to the park. The survey will define the boundaries and enable fencing to be done in some places against straying stock. The boundary lines will be cleared of brush and furnished with guideposts wherever crossed by trails.

Improvements Projected.

In addition to the lines of work now under way, the principal improvements scheduled for the immediate future are the construction of a lodge for the warden, the installing of a water system for Governor's Camp and the warden's lodge, and a road-sprinkling system.

The warden's lodge will be built at the park entrance opposite the new log barn, on a five-acre tract donated to the State for this purpose by Mr. H. L. Middleton. Plans for the lodge have been submitted and considerable material has been gotten out in preparation for its erection early in the coming summer.

In view of the fact that water for household uses can be obtained in the park only by carrying it from the streams and other means quite as primitive, and especially since companies owning the timber in the upper watershed of the stream from which the supply is obtained are preparing to begin cutting, it becomes necessary to install a permanent system for camp use. Abundant water of excellent quality can be obtained from a living spring a short distance above Governor's Camp. This work should receive attention during the coming summer.

It will be necessary also to obtain water for use at the warden's lodge before it is occupied. Here the water will have to be raised from the creek below, consequently an engine and pump will have to be put in. A tank should be erected above the lodge to hold water for use in emergencies.

Desirable Improvements.

There is pressing need of a moderate-sized hotel inside the park, where employés may board and visitors may obtain accommodations.

The present lack of accommodations burdens the warden with the responsibility of boarding employés and very often providing for visitors. This is undesirable, because it is liable at any time to arouse criticism on the ground that the warden is making a profit from keeping a boarding-house. More important from the standpoint of the State, however, is the fact that this work takes up some of the time which the warden owes the State. The only way to remedy the situation is to induce some hotel-keeper to open a hotel there. This is of immediate importance.

Quite a large area near the eastern side of the park was burned over in 1904 and many large redwood trees were killed. These should be cut in order to improve the appearance of the park and to remove the danger from falling limbs. At present all money obtained from the sale of such material must be turned into the general fund. If this clause is amended by the coming Legislature to permit the proceeds from such material to be reinvested in the park, steps should be taken immediately to dispose of all dead timber. Probably the most satisfactory way will be to set up a small mill on the tract, temporarily, and cut the lumber into shingles.

Visitors.

During the past summer the park has been visited by about half the normal number of people. This reduction is attributable to the earthquake which destroyed the tunnels on the narrow-gauge railroad from San Francisco to Santa Cruz, causing the road to be blocked all summer, and to the partial destruction of the City of San Francisco. Fewer people have cared to take the trip since it has been increased by the long detour via San José, and fewer from San Francisco have been in a position to afford recreation. There is no doubt that the opening of this road and the betterment of conditions in the city, which will prevail next summer, will bring the number of visitors up to those of former seasons, at least.

During the summer months a daily stage was run from Boulder Creek to Governor's Camp by W. M. Elsom, under permission from the State Board of Forestry.

Further Acquirement of Land.

The north boundary of the park is indented by a half-section of private land, known as the Harrington claim, owned by the McAbee Brothers Timber Company. This is largely good redwood, very attractive scenically, and especially important as the source of one of the main streams which traverse the park. It could not be acquired when the park was purchased, because one of the joint owners refused to sell.

Now, however, it can be acquired, and should be if a reasonable price will be accepted, for it is useless to the owners for any purpose but logging, and this would damage the park immeasurably.

Between the park and the coast are several parcels of vacant Government land of too small commercial value to have attracted claimants. Senator Perkins has been asked to induce Congress to grant these to the State as additions to the park. This project should be agitated, for eventually the intervening lands can be secured at a small price after being logged, and reforested by a few years' protection, then the whole will make a most valuable addition to the park. This is desirable, not only to increase the area, but to perfect control and thus be able to guard the more valuable portions from outside fires and loss of wild game.

EXPENSES OF CALIFORNIA REDWOOD PARK.

July 1, 1906, to October 31, 1906.

Warden's salary.....	\$500 00	
Labor on fire lines.....	1,315 79	
Labor on clearing.....	345 75	
Labor on telephone line.....	258 50	
Supplies, tools, lumber, etc.....	165 06	
Labor on lodge material.....	92 40	
Repairs	35 75	
		<hr/>
Total		\$2,713 25
Balance July 1, 1906.....		11,389 13
		<hr/>
Balance November 1, 1906.....		\$8,675 88

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